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Prediction of 30-day mortality after endovascular repair or open surgery in patients with ruptured abdominal aortic aneurysms

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Objective: To validate the Glasgow Aneurysm Score (GAS) in patients with ruptured abdominal aortic aneurysms (AAAs) treated with endovascular repair or open surgery and to update the GAS so that it predicts 30-day mortality for patients with ruptured AAA treated with endovascular repair or open surgery.
Methods: In a multicenter prospective observational study, 233 consecutive patients with ruptured AAAs were evaluated; 32 patients did not survive to repair and statistical analysis was performed using collected data on 201 patients. All patients who were treated with endovascular repair (n = 58) or open surgery (n = 143) were included. The GAS was calculated for each patient. The area under the receiver operating characteristics curve (AUC) was used to indicate discriminative ability. We tested for interactions between risk factors and the procedure performed. The GAS was updated to predict 30-day mortality after endovascular repair or open surgery in patients with ruptured AAAs using logistic regression analysis.
Results: Thirty-day mortality was 15/58 (26%) for patients treated with endovascular repair and 57/143 (40%) for patients treated with open surgery (P = .06). The AUC for GAS was 0.69. No relevant interactions were found. The updated prediction rule (AUC = 0.70) can be calculated with the following formula: + 7 for open surgery + age in years + 17 for shock + 7 for myocardial disease + 10 for cerebrovascular disease + 14 for renal insufficiency.
Conclusion: We showed limited discriminative ability of the GAS and therefore updated the GAS by adding the type of procedure performed. This updated prediction rule predicts 30-day mortality for patients with ruptured AAAs treated with endovascular repair or open surgery.

Outcome of renal stenting for renal artery coverage during endovascular aortic aneurysm repair

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Objective: This study was conducted to determine the outcome of adjunctive renal artery stenting for renal artery coverage at the time of endovascular abdominal aortic aneurysm repair (EVAR).
Methods: Between August 2000 and August 2008, 29 patients underwent elective EVAR using bifurcated Zenith stent grafts (Cook, Indianapolis, Ind) and simultaneous renal artery stenting. Renal artery stenting during EVAR was performed with endograft ''encroachment'' on the renal artery ostium (n = 23) or placement of a renal stent parallel to the main body of the endograft (''snorkel,'' n = 8). Follow-up included routine contrast-enhanced computed tomography (CT), multiview abdominal radiographs, and serum creatinine measurement at 1, 6, and 12 months, and then yearly thereafter.
Results: Thirty-one renal arteries were stented successfully in 29 patients. The 18 patients with planned renal artery stent placement had a proximal neck length $<$15 mm. Mean proximal neck length was shorter in patients who underwent the ''snorkel'' technique (6.9 $\pm$ 3.1 mm) compared with those with planned endograft encroachment (9.9 $\pm$ 2.6 mm). None of the patients with unplanned endograft encroachment had neck lengths $<$15 mm (mean length, 26.3 $\pm$ 10.2 mm). Mean proximal neck angulation was 42.8° $\pm$ 24.0° and did not differ between the groups. One patient had a type I endoleak on completion angiography, and two additional patients had a type I endoleak on the first postoperative CT scan. All type I endoleaks resolved by the 1-month postoperative CT scan. The primary assisted patency of renal artery stents was 100% at a median follow-up of 12.5 months (range, 2 days-77.4 months). In one patient near occlusion of a renal artery stent was noted on follow-up CT scan at 9 months; patency was restored by placement of an additional stent. One patient required dialysis after sustained hypotension from a right external iliac artery injury that resulted in prolonged postoperative bleeding. Mean serum creatinine was 1.1 $\pm$ 0.3 mg/dL at baseline, 1.2 $\pm$ 0.5 mg/dL at 1 month of follow-up, and 1.2 $\pm$ 0.5 mg/dL at 2 years of follow-up. There were no late type I endoleaks ($>$1 month postoperatively) or stent graft migrations.
Conclusions: Adjunctive renal artery stenting during endovascular AAA repair using the ''encroachment'' and ''snorkel'' techniques is safe and effective. Short- and medium-term primary patency rates are excellent, but careful follow-up is needed to determine the durability of these techniques.

Implementation of an aortic screening program in clinical practice: Implications for the Screen for Abdominal Aortic Aneurysms Very Efficiently (SAAAVE) Act

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Objective: Screening for abdominal aortic aneurysms (AAA) significantly reduces aneurysm-related death. In January 2007, the Federal government enacted Medicare coverage guideline to screen persons at risk for the presence of an AAA, the Screen for Abdominal Aortic Aneurysms Very Efficiently (SAAAVE) Act. The purpose of this study is to evaluate the efficacy and costs of a large scale screening effort for identifying AAAs in patients in clinical practice.
Methods: A regional veterans affairs mandate for screening for AAA was implemented in February 2007. Data were extracted through the Northern California Veterans Affairs (VA) Service Network to identify veteran males 65–75 years of age who ever smoked at least 100 cigarettes during their lifetime. An AAA was defined as an aortic diameter 3.0 cm or greater. A Decision Support Systems software (LumiData, Minneapolis, Minn) package tracked true costs of conducting a large AAA screening protocol in the Northern California VA Health Care System.
Results: A total of 2918 patients (average age, 71 $\pm$ 6 years) were screened for AAA over a 1-year period from February 2007 to February 2008. An AAA was diagnosed in 5.1% (148/2918) of patients. Two hundred ninety patients out of the 2918 (9.9%) were inappropriately screened. The aneurysm distribution was as follows: 83% (123/148) of the aneurysms were 3.0–4.4 cm, 13% (19/148) were 4.5–5.5 cm, and 4.1% (6/148) were greater than 5.5 cm. Incidental findings of isolated iliac artery aneurysms were found in 0.1% (3/2918) of patients, 13% (19/148), and 4.1% (6/148) in the 3.0–4.4 cm, 4.5–5.4 cm, and 5.5 cm or greater diameter groups, respectively. The cost of AAA screening per patient is $53.

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Conclusion: The results of a large AAA screening effort in clinical practice reflect the results reported in the major clinical trials at a reasonable cost. The identification of large iliac artery aneurysms in the screening has not been previously reported.

A population-based analysis of endovascular versus open thoracic aortic aneurysm repair

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Objective: The perioperative outcomes of open surgical and endovascular repair of intact thoracic aortic aneurysms (TAAs) during the last 3 months of 2005 were compared using a national administrative database.
Methods: The Nationwide Inpatient Sample was used to identify patients undergoing open aneurysm repair (OAR) or endovascular TAA repair (TEVAR) from October 1 to December 31, 2005. Patient demographic data, length of stay, hospital charges, patient disposition, and mortality were examined. Where appropriate, univariate tests of association used the χ^2 test, and multiple logistic regression analysis was used to determine predictors of in-hospital mortality, complications, and discharge status.
Results: A total of 1030 patients underwent open TAA repair and 267 underwent TEVAR. There was no significant difference in mortality between OAR and TEVAR (adjusted odds ratio [OR], 1.2; 95% confidence interval [CI], 0.73—2.12), although OAR patients were more likely to have cardiac, respiratory, and hemorrhagic complications. Patients undergoing TEVAR were more likely to be discharged to home (adjusted OR, 6.37; 95% CI, 2.93—13.70) and had a decreased length of stay (5.7 days vs 9.9 days; $P = .0015$). The differences in hospital charges and costs were not significant.
Conclusion: Although further study is warranted, this study of a national sample suggests that endovascular TAA repair is safe in the short-term, associated with fewer cardiac, respiratory, and hemorrhagic complications, and requires a shorter hospital stay.

Laparoscopic abdominal aortic aneurysm repair in octogenarians

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Objective: Open abdominal aortic aneurysm (AAA) repair in octogenarians is considered to have higher risks of mortality and systemic complications compared with younger patients. The purpose of our work is to present our experience with total laparoscopic repair for AAA in this subset of patients.
Methods: From February 2002 to February 2008, 29 octogenarian patients underwent total laparoscopic AAA repair. Median age was 82 years (range, 80—85 years). Median aneurysm size was 52 mm (range, 40—85 mm). Disease was classified as American Society of Anesthesiologist (ASA) class II in 12 patients and class III in 17 patients. Ten patients presented with past medical history of myocardial infarct (34.5%).
Results: We implanted 12 tube grafts and 17 bifurcated grafts. Twenty-six procedures were totally laparoscopic (89.6 %). Median operative time and aortic clamping time were 280 min (range, 160—480 min) and 75 min (range, 22—125 min), respectively. Two patients with juxtarenal AAA underwent suprarenal clamping. Median blood loss was 1100 cc (range, 600—3000 cc). Four patients (13.8%) needed adjunctive vascular procedures because of intraoperative complications. Two patients died in the postoperative course (6.9%). Four patients developed severe systemic non-lethal complications (14.8%, pneumopathies). Mild or moderate systemic complications were observed in 14 patients (51.8%) including transient renal insufficiencies without dialysis (13) and cardiac arrhythmia (1). Postoperative creatinine levels returned to baseline before discharge in all patients. Liquid diet was reintroduced after a median duration of 2 days (range, 1—10 days) and most patients were ambulatory by day four (range, 3—30 days). Median stays in intensive care unit and hospital were 72 hours (range, 12—1368 hours) and 11 days (range, 6—74 days), respectively. Sixteen patients (59.2%) were discharged directly to home with complete recovery. After a median follow-up of 24 months (range, 2—48 months), 23 patients are still alive and regained their baseline status. Four patients died after hospital discharge of non-vascular etiologies.
Conclusion: Total laparoscopic AAA repair is a worthwhile but challenging procedure in octogenarians. Laparoscopy is complementary to open surgery and EVAR in this subset. These results encourage us to offer laparoscopic AAA repair in good surgical risk octogenarians.

Carotid artery stenting: Impact of practitioner specialty and volume on outcomes and resource utilization

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Objectives: A variety of endovascular specialists perform carotid artery stenting (CAS), but little data exist on outcomes and resource utilization among these specialists. We analyzed differences in outcomes after CAS was performed by radiologists (RAD), cardiologists (CRD), and vascular surgeons (VAS).
Methods: Secondary data of the 2005-2006 State Inpatient Databases for New Jersey were analyzed. Patients with elective admission to the hospital who had CAS procedure $\leq$2 days were identified. Physician specialty was identified and cost was calculated. CAS outcomes were analyzed with respect to practitioner specialty and volume, associated complications, and hospital resource utilization.
Results: We identified 625 CAS cases. CRD performed 378 (60.5%), VAS, 199 (31.8%); and RAD, 48 (7.7%). The overall stroke rate was 2.72% and by specialty was CRD, 3.17%; VAS, 2.01%, and RAD, 2.08% ($P = .6880$). The overall cardiac complication rate was 2.40% (CRD, 2.12%; VAS, 3.02%; RAD, 2.08%; $P = .7899$). Renal and pulmonary complications were low (0.64% and 0.32%, respectively). Mean hospital length of stay (LOS) in days was significantly shorter for VAS (1.64 ± 1.40) compared with RAD (2.83 ± 5.15; $P = .0167$) and had the same trend compared with CRD (2.14 ± 3.37; $P = .0649$). Intensive care unit (ICU) LOS was shorter for VAS (0.52 ± 0.97) and CRD (0.30 ± 0.71) than for RAD (2.12 ± 4.48; $P < .0001$). The mean total hospital cost was significantly greater for RAD ($\$20,987 \pm \$26,603$) and CRD ($\$18,182 \pm \$16,364$) than for VAS ($\$10,000 \pm \$4947$; $P = .0011$ and $P < .0001$, respectively). ICU cost for RAD ($\$5.963 \pm \$14,551$) was also more than for VAS ($\$864 \pm \$1514$; $P < .0001$) and CRD ($\$473 \pm \$1561$; $P < .0001$). Medical supply costs were significantly greater for CRD ($\$8772 \pm \$9546$) than for VAS ($\$3354 \pm \$2261$; $P < .0001$) and RAD ($\$4964 \pm \$2595$; $P = .0142$). Total hospital cost, LOS, and medical supplies were significantly lower for high-volume practitioners vs low-volume practitioners ($P < .0001$).
Conclusion: Stroke rates after CAS did not vary significantly among practitioner specialties. Hospital resource utilization did vary significantly: Vascular surgeons had the lowest utilization of hospital resources for performing CAS. High practitioner volume was associated with lower hospital resource utilization. Elucidation of factors creating resource utilization disparities among endovascular practitioners may lead to improved patient outcomes and permit significant future cost savings for carotid interventions.

Vascular surgery training trends from 2001—2007: A substantial increase in total procedure volume is driven by escalating endovascular procedure volume and stable open procedure volume

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Background: Endovascular procedure volume has increased rapidly, and endovascular procedures have become the initial treatment option for many vascular diseases. Consequently, training in endovascular procedures has become an essential component of vascular surgery training. We hypothesized that, due to this paradigm shift, open surgical case volume may have declined, thereby jeopardizing training and technical skill acquisition in open procedures.
Methods: Vascular surgery trainees are required to log both open and endovascular procedures with the Accreditation Council for Graduate Medical Education (ACGME). We analyzed the ACGME database (2001—2007), which records all cases (by Current Procedural Terminology [CPT] code) performed by graduating vascular trainees. Case volume was evaluated according to the mean number of cases performed per graduating trainee.
Results: The mean number of total major vascular procedures performed per trainee increased by 174% between 2001 and 2007 (from 298.3 to 519.2). Endovascular diagnostic and therapeutic procedures increased by 422% (from 63.7 to 269.1) and accounted for 93.0% of the increase in total procedures. The number of open aortic procedures (aneurysm, occlusive, mesenteric, renal) decreased by 17.1% (from 49.7 to 41.2), while the number of endovascular aortic aneurysm repair procedures increased by 298.8% (from 16.9 to 50.5). Specifically, open aortic aneurysm procedures decreased by 21.8%, aortobifemoral bypass increased by 3.2%, and open mesenteric or renal procedures decreased by 13%. Infrainguinal bypass

procedures remained relatively constant (from 37.6 to 36.5, 2.9% decrease), and the number of carotid endarterectomy procedures performed did not change significantly (from 43.6 to 42.2, 3.2% decrease).
Conclusion: Vascular surgery trainees are performing a vastly increased total number of procedures. This increase in total procedure volume is almost entirely attributable to the recent increase in endovascular procedures. Aside from a small decline in open aortic procedures, the volume of open surgical procedures has largely remained stable. It is essential that vascular surgery training programs continue to focus on both endovascular and open surgical skills in order for vascular surgeons to remain the premier specialists to care for patients with vascular disease.

An aid to accessing the distal internal carotid artery

A. Ross Naylor, Andrew Moir

Accessing the distal internal carotid artery can be a challenge to even the most experienced vascular surgeon. In most patients, the need for distal exposure can be anticipated in advance, thereby enabling the surgeon to consider simple measures, such as nasolaryngeal intubation, or more complex interventions, such as temporomandibular subluxation, to facilitate access. Once the procedure is underway, however, neither of these strategies can be used. The advantage of the approach described in this article is that it can be used at any time during the operation.